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OPERATING INSTRUCTIONS

1209-B

PROPERTY OF ENG'G DIV.
P. R. D.

TYPE 1209-B
UNIT OSCILLATOR

. . . . SINCE 1915
manufacturers of
electronic apparatus
for science and industry

GENERAL RADIO COMPANY
CAMBRIDGE 39, MASSACHUSETTS, USA

OPERATING INSTRUCTIONS

TYPE 1209-B
UNIT OSCILLATOR

Form 732-F
April, 1956

GENERAL RADIO COMPANY

275 MASSACHUSETTS AVENUE
CAMBRIDGE 39 MASSACHUSETTS

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New York 6, New York

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REPAIR SERVICES

EAST COAST

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Cambridge 39, Massachusetts

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Western Instrument Company
826 North Victory Boulevard
Burbank, California

CANADA

Bayly Engineering, Ltd.
First Street
Ajax, Ontario

Printed in U.S.A.

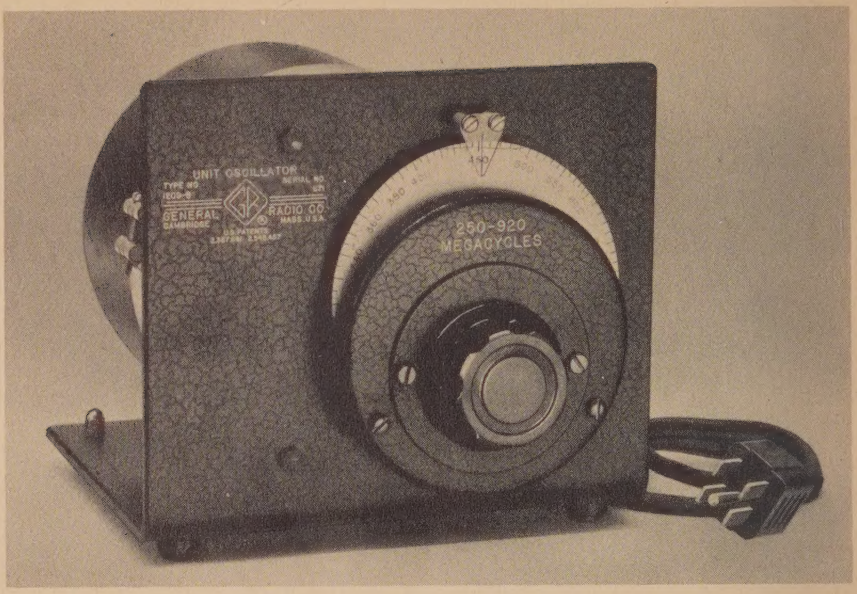

Figure 1. Type 1209-B Unit Oscillator.

SPECIFICATIONS

Frequency Range: 250 to 920 Mc.

Tuned Circuit: Butterfly, with no sliding contacts.

Frequency Control: 4-in. dial with calibration over 270 deg. Slow-motion drive, 4-1/2 turns.

Frequency Calibration Accuracy: ±1%.

Warm-up Frequency Drift: 0.2%.

Output System: Short coaxial line with adjustable coupling loop on one end and coaxial connector on other. Max. power can be delivered to load impedances normally met in coaxial systems.

Output Power: Into 50 ohms, 200 mw at any frequency.

Modulation: Plate modulation of 30% at audio frequencies can be produced by external source of 40 volts. Input impedance is about 8000 ohms. Type 1000-P6 Crystal Diode Modulator and Type 1000-P7 Balanced Modulator are recommended to avoid incidental FM. Refer to table in paragraph 1.3.

Power Supply Requirements: 330 v at 36 ma; 6.3 v at 0.4 amp.

Oscillator Tube: Sylvania Type RT 434.

Mounting: Aluminum casting surrounded by spun-aluminum container. Assembly is then mounted on L-shaped panel and chassis piece.

Accessories Supplied: Type 874-R22 Cable, Type 874-PB58 Panel Connector, Jones socket, and telephone plug.

Accessories Available: Refer to table in paragraph 1.3.

Dimensions: Height 6¼ in., width 9¼ in., depth 7 in., over-all.

Weight: 6¼ lbs.

U. S. Patent No. 2,548,457

GENERAL RADIO EXPERIMENTER reference: Vol XXIV No. 12, May 1950
Vol XXIX No. 11, April 1955

TYPE 1209-B UNIT OSCILLATOR

Section 1
INTRODUCTION

1.1 PURPOSE. The Type 1209-B Unit Oscillator (Figure 1) is a general-purpose power source for the radio-frequency laboratory. Covering the range of from 250 to 920 Mc, this member of the convenient Unit Instrument line can be used to drive bridges, slotted lines, impedance comparators, and other measuring equipment. Used with a voltmeter and attenuator, it provides an accurately known output voltage for the testing of receivers. Direct amplitude modulation is possible over the audio-frequency range, and amplitude modulation free from incidental fm can be obtained with a simple crystal-diode modulator over the frequency range from zero to 5 Mc. Connected to a mixer, the Unit Oscillator can be used as the local oscillator in a heterodyne receiver to convert the Type 1216-A Unit I-F Amplifier or a low-frequency communications receiver into a detector for v-h-f and u-h-f signals. Pulsing and linear 100-percent amplitude modulation can be obtained with an external balanced modulator.

1.2 DESCRIPTION. The tuning system of the Type 1209-B Unit Oscillator is a "butterfly" circuit, which combines a variable air capacitor and a variable inductor in a single unit with no sliding contacts. Inductance varies from 0.012 μh at the low-frequency end to 0.004 μh at the high-frequency end, and capacitance varies from 40 μμf to 7 μμf. The vernier dial requires about 4-1/2 turns to rotate the main dial over its full 270 degrees. The rotor of the tuning unit is geared down for 80-degree rotation. The frequency calibration is accurate within 1 percent.

Plate and grid of the oscillator tube are connected to the tuned circuit, and the cathode is left floating. The oscillator circuit is of the Colpitts type, with feedback determined essentially by the electrode capacitances of the tube. A small amount of cathode-plate capacitance has been added.

The output system is a short coaxial line, with a coupling loop on one end and a Type 874 Coaxial Connector on the other. Coupling between the loop and the oscillator can be adjusted over a wide range, and the loop can be clamped in the desired position. Maximum power can be delivered to load impedances normally encountered in coaxial systems.

1.3 ACCESSORIES. The following table lists accessories recommended for use with the Type 1209-B Unit Oscillator.

TABLE OF ACCESSORIES

Accessory and Function	Instrument	Remarks
POWER SUPPLIES		
Standard	Type 1203-A Unit Power Supply	115-v, 50-60-cps line
Stabilized Plate Voltage	Type 1201-A Unit Regulated Power Supply	105-125-v, 50-60-cps line
Battery Operation	Type 1202-A Unit Vibrator Power Supply	6- or 12-v battery or 115-v, 60-cps line
Adjustable Plate Voltage	Type 1204-A Unit Variable Power Supply	115-v, 60-cps line
Constant Output Level vs Frequency	Type 1263-A Amplitude Regulating Power Supply with Type 874-VR Voltmeter Rectifier, Type 874-Q6 Adaptor, and Type 274-NF Patch Cord	115- or 230-v, 50-60-cps line
MODULATORS		
Plate Modulation	Type 1214-A Unit Oscillator	400 and 1000 cps output, 115-v, 40-60-cps line
Absorption Modulation with no Incidental Fm	Type 1000-P6 Crystal-Diode Modulator	Requires modulation source. Maximum output 10 mv.
Balanced Modulation for linear 100-percent amplitude modulation and for pulses with high degree of carrier suppression	Type 1000-P7 Balanced Modulator	Requires modulation source. Modulation frequency range 0-20 Mc.

TABLE OF ACCESSORIES (Cont)

Accessory and Function	Instrument	Remarks
SWEEP DRIVE Automatic Frequency Sweep	Type 1750-A Sweep Drive	Type 1263-A Amplitude-Regulating Power Supply recommended to keep oscillator output level constant.
RELAY RACK PANEL	Type 480-P4UC2	For Types 1203-A and 1209-B or for 1201-A and 1209-B
ADAPTORS - available for connecting Type 874 coaxial output terminals to Types N, BNC, C, UHF, and HN coaxial systems.		

Section 2

OPERATING PROCEDURE

2.1 INSTALLATION. The Type 1209-B Unit Oscillator is shipped complete with tube installed, and when connected to a suitable power supply is ready for use. A cord and connector are supplied with the instrument for direct connection to a General Radio Unit Power Supply. Connect the oscillator to the equipment under test by means of the three-foot coaxial cable supplied. If necessary, install one of the two connectors supplied on the equipment under test; or use one of the many adaptors available for various coaxial systems.

If a power supply other than a Unit Power Supply is used, it should be capable of supplying 330 volts at 36 milliamperes and 6.3 volts at 0.4 ampere. To reduce these requirements, the series and shunt resistors in the base of the oscillator could be disconnected, but care must be taken not to overload the tube under various operating conditions. Plate dissipation of the oscillator tube should be limited to 5 watts, and best operation will be obtained with a plate current of 30 milliamperes at 165 volts.

2.2 OPERATION. After turning on the power supply, adjust the frequency by means of the frequency dial, and adjust the output by rotating the output coupling loop. For low output the coupling loop can be partly withdrawn.

For amplitude modulation the audio modulating voltage should be inserted at the jack at the side of the base. Full plate current must flow through the modulating source. A modulating voltage of about 40 volts is required for 30-percent modulation. The input impedance is about 8000 ohms.

2.3 FREQUENCY DEVIATION. For some applications a well-regulated and filtered power supply should be used to avoid frequency variations caused by line-voltage fluctuation and to produce a clearer beat note at the highest frequencies. A line-voltage variation of 20 percent causes a frequency change of about 0.01 percent at frequencies up to 600 Mc, and a frequency change of about 0.05 percent at the top end of the frequency range.

Amplitude modulation over the audio range can be obtained by an audio-frequency voltage superimposed in the d-c power supply. Incidental fm, inherent in this system, is about 0.01 percent for 50-percent amplitude modulation at carrier frequencies up to 400 Mc, and 0.1 percent at the high-frequency end.

Section 3

APPLICATIONS

3.1 GENERAL. The utility and versatility of the Type 1209-B Unit Oscillator are greatly increased by the large selection of Type 874 coaxial elements, available from General Radio Company. These elements are part of a complete, integrated line of equipment for the measurement of voltage, power, and standing-wave ratio at very-high and ultra-high frequencies. Although the Unit Oscillator is intended primarily as a source of power for this measuring equipment and for other impedance-measuring devices such as the Type 1602-A U-H-F Admittance Meter, use of the coaxial elements can adapt the Unit Oscillator to various applications in the radio-frequency laboratory in place of more expensive equipment that is not always available. The tuning circuit of the Type 1209-B Unit Oscillator uses ball bearings, and thus can be motor-driven, for sweep applications, by such drives as the General Radio Type 1750-A Sweep Drive.

Three applications are described in detail in the following paragraphs. Others will be suggested by a study of the complete list of Type 874 Coaxial elements, included in the General Radio Catalog.

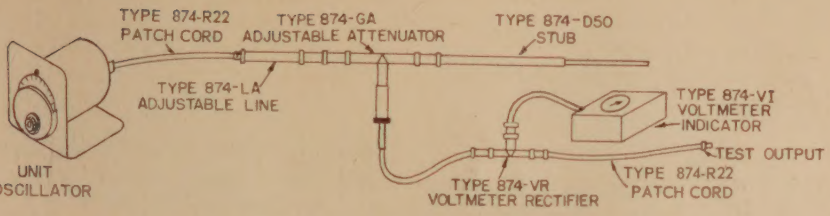

Figure 2. Setup of Unit Oscillator and Accessories for Use as Standard-Signal Generator.

3.2 UNIT OSCILLATOR AS SIGNAL GENERATOR FOR RECEIVER TESTING. The Type 1209-B Unit Oscillator, as a well-shielded power source, can be used as a signal generator to test receivers if means are available to measure and attenuate the output. The Type 874-VR Voltmeter Rectifier, Type 874-VI Voltmeter Indicator, and Type 874-GA Adjustable Attenuator are suitable for this purpose, and should be connected to the Unit Oscillator as shown in Figure 2. Also, a Type 874-D50 Adjustable Stub is required to produce a current maximum at that point of the attenuator where the adjustable output loop is coupled. A tuning element between the oscillator and the attenuator is required to increase the output to a value that can be read on the voltmeter. At higher frequencies coverage is obtained by a Type 874-LA Adjustable Line. At lower frequencies additional lengths of line must be used.

Current from the Unit Oscillator is fed through the attenuator into the short circuit at the stub. The attenuator is calibrated in decibels. At minimum attenuation the attenuator output is measured by a crystal diode in the voltmeter rectifier and read on the meter of the voltmeter indicator. Means are provided to standardize the crystal indication. A 50-ohm resistor after the crystal determines the output impedance.

With the above-described arrangement, the maximum available output is several tenths of a volt. The attenuator calibration covers 120 db, but shielding of the Unit Oscillator and of other components is not sufficient for accurate measurements in the microvolt region.

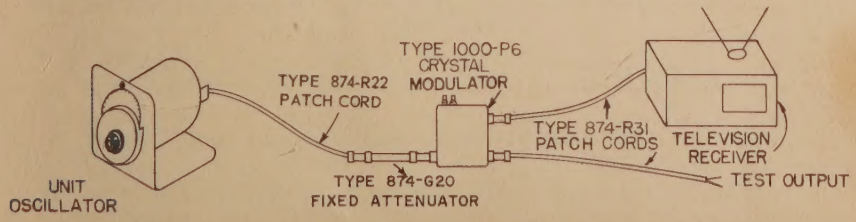

Figure 3. Setup of Unit Oscillator with Video Modulator for Use as Television Signal Generator.

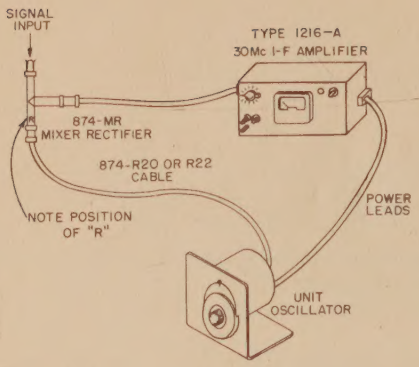

Figure 4. Setup of Unit Oscillator and Mixer Rectifier for Use as Frequency Converter.

3.3 UNIT OSCILLATOR AS A TELEVISION SIGNAL GENERATOR. Used in combination with a Type 1000-P6 Crystal Diode Modulator and a Type 874-G20 20-db Fixed Attenuator, the Unit Oscillator is a convenient source of television signals over its entire carrier-frequency range if video modulating voltage is available. (See Figure 3.) The modulating voltage required can be obtained from a standard television receiver tuned to the local channel.

Since the modulator and oscillator are separated from each other by an attenuator pad, amplitude modulation is free from incidental fm. Output is about 10 millivolts.

3.4 UNIT OSCILLATOR AS A FREQUENCY CONVERTER. Connected to a Type 874-MR Mixer Rectifier, the Unit Oscillator can provide the local signal in a heterodyne converter to adapt the Type 1216-A Unit I-F Amplifier for use as a sensitive detector for v-h-f and u-h-f signals. (See Figure 4.) Without additional tuning, the conversion loss is about 6 db at an intermediate frequency of 30 Mc.

Section 4

SERVICE AND MAINTENANCE

4.1 GENERAL. This service information should enable the user to locate and correct ordinary difficulties resulting from normal use. Major problems should be referred to our Service Department, which will cooperate as much as possible by furnishing information and instructions, as well as by supplying any replacement parts needed. When notifying our Service Department of any difficulties in operation or ser-

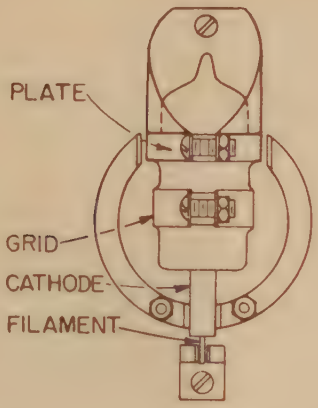

Figure 5. Installation Detail of Oscillator Tube.

vice, specify the serial and type numbers of the instrument. Also report the trouble encountered and steps taken to eliminate the trouble.

Before returning an instrument or part for repair, please write to our Service Department, requesting a Returned Material Tag, which includes shipping instructions. Use of this tag will insure proper handling and identification. A purchase order covering repair of material returned should also be forwarded to avoid unnecessary delay.

4.2 INSTALLATION OF OSCILLATOR TUBE. When it is necessary to replace the Type RT-434 oscillator tube, install the new tube as follows (see Figure 5):

a. Remove the screw holding the plate clamp.
b. Loosen the grid clamp screw until the tube can be slid into position. Place the cathode connection just short of the filament clip.
c. Carefully tighten the grid clamp, holding it in place on the tube firmly.
d. Replace the plate screw and carefully tighten the plate clamp.

CAUTION

Be careful when tightening clamps. Glass seals are fragile.

e. Restore frequency calibration, if necessary, in accordance with paragraph 4.3.

4.3 FREQUENCY CALIBRATION. Replacement of the oscillator tube may affect frequency calibration. It can be restored by adjustment of the flexible tab on the plate connector. Before adjusting this trimmer capacitor, allow the instrument to warm up, since warm-up drift may be as much as 0.2 percent. The oscillator shield affects frequency considerably, especially at the low-frequency end.

Section 5

PARTS LIST

REF DESIG	DESCRIPTION	PART NO.
C1	CAPACITOR, Fixed mica, 200 μμf ±10%	COU-24
C2	CAPACITOR, Fixed mica, 200 μμf ±10%, 500 dcwv	COU-8-2
C3A	CAPACITANCE, Built-in air adjustment	
C3B	CAPACITANCE, Built-in air adjustment	
C4	CAPACITOR, Fixed mica, 500 μμf ±10%	COU-24
C5	CAPACITOR, Fixed mica, 500 μμf ±10%, 500 dcwv	COU-8-2
C6	CAPACITANCE, Built-in air adjustment	
C7	CAPACITOR, Fixed mica, 100 μμf, built-in	
C8	CAPACITOR, Fixed mica, 500 μμf ±10%, 500 dcwv	COU-8-2
C9	CAPACITOR, Fixed mica, 500 μμf ±10%	COU-24
C10	CAPACITOR, Fixed electrolytic, 20 μf +100% -10%, 450 dcwv	COE-5
J1	JACK	CDSJ-10
L1	INDUCTOR, 45 μh	ZCHA-9
L2	INDUCTOR, 45 μh	ZCHA-9
L4	INDUCTOR, 20 μh	ZCHA-29
L6	INDUCTOR, 45 μh	ZCHA-9
L7	INDUCTOR (R-F pickup loop)	874-403
L8	INDUCTOR, 20 μh	ZCHA-29
LC1	BUTTERFLY, 250 - 920 Mc, built in	
LR1	HEATER FILTER	1021-216
PL1	PLUG	1209-34
R1	RESISTOR, Fixed, wire-wound, 560Ω ±10%, 2 w	REW-6C
R4	RESISTOR, Fixed composition, 1 k ±10%, 1/2 w	REC-20BF
R5	RESISTOR, Fixed power, 4.7 k ±10%, 10 w	REPO-22
R6	RESISTOR, Fixed composition, 21.5 k ±10% (two 43-k ±5% resistors in parallel), 2 w	REC-41BF

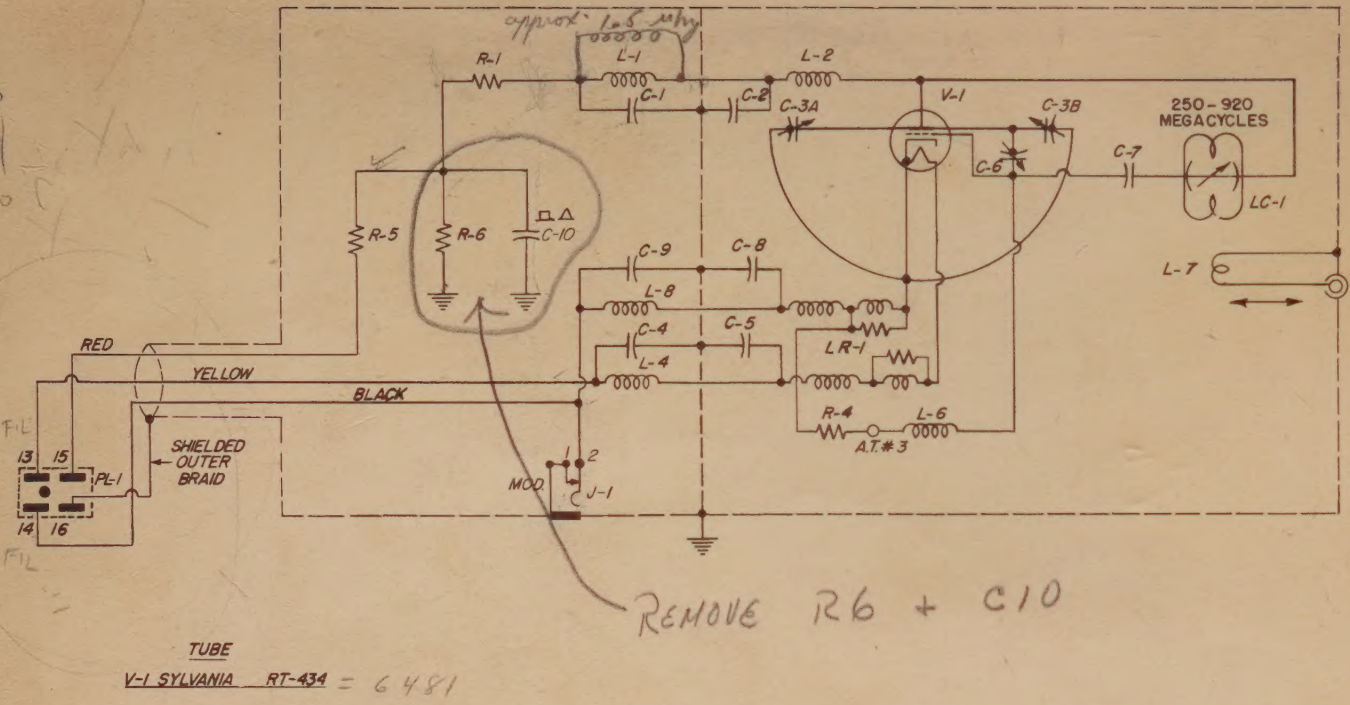

Figure 6. Schematic Diagram of Type 1209-B Unit Oscillator.